NON-PUBLIC?: N
ACCESSION #: 9001100063
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Virgil C. Summer Nuclear Station PAGE: 1 OF 05

DOCKET NUMBER: 05000395

TITLE: Reactor Trip on Low-Low Level Following Turbine Trip
EVENT DATE: 12/02/89 LER #: 89-020-00 REPORT DATE: 01/02/90

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: W. R. Higgins, Supervisor, Regulatory Compliance

TELEPHONE: (803) 345-4042

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: JJ COMPONENT: RLY MANUFACTURER: G080
REPORTABLE NPRDS: N

CAUSE: B SYSTEM: EL COMPONENT: BKR MANUFACTURER: G080

REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On December 2, 1989, dt approximately 2202 hours, operations personnel started a load reduction to 90% power for the monthly turbine control valve testing. When the operator pushed the load selector decrease button for the second 2% reduction in power the turbine commenced d rapid power decrease (2209 hours). Operations personnel attempted to counter the loss of load by selecting manual increase; however, the turbine controls failed to respond and the turbine was manually tripped when turbine power decreased below P-9 (Power Permissive < 50% Rated Thermal Power). The exciter field breaker initially failed to open from the Main Control Board (MCB). An operator was immediately dispatched to locally

open the breaker. The breaker finally opened after several attempts to cycle the breaker from the MCB.

Main feedwater was manually secured at 2220 hours when the turbine runback transient caused a high level in the deareater (DA). When main feedwater was restored at 2221 hours, the addition of cooler (280 degrees F) water caused a rapid RCS cooldown and steam generator levels to shrink to below the low-low steam generator level reactor trip setpoints. A reactor trip occurred at 2222 hours on "C" Steam Generator low-low level. With the exception of the previously mentioned problems the plant response was normal. A failed turbine control circuit board was replaced and the exciter field breaker PM'd prior to authorizing the plant restart.

Additional actions have been initiated by SCE&G to modify the turbine control circuit and increase the PM frequency on the exciter field breaker.

END OF ABSTRACT

PLANT IDENTIFICATION:

Westinghouse - Pressurized Water Reactor

EQUIPMENT IDENTIFICATION:

Electrohydraulic Control Panel Relay - EIIS - JJ
Alterex Exciter Field Breaker - EIIS - EL

IDENTIFICATION OF EVENT:

On December 2, 1989, at approximately 2209 hours, the turbine commenced a rapid power decrease due to a failure in the turbine control system. At the time of the occurrence, power was being decreased to approximately 90% for routine turbine control valve testing. At 2217 hours the main generator breaker and the turbine were manually tripped after power had decreased below P-9 (Power Permissive < 50% Rated Thermal Power). A reactor trip occurred at 2222 hours on low-low steam generator level during restoration of main feedwater flow to the steam generators. The increased flow in feedwater at a temperature of 280 degrees F caused a rapid shrink in all steam generator levels.

EVENT DATE:

December 2, 1989, at 2222 hours

REPORT DATE: January 2, 1990

This report was initiated by Off-Normal Occurrence Number 89-107.

CONDITION PRIOR TO EVENT:

Mode 1 - 100% Power

DESCRIPTION OF EVENT:

On December 2, 1989, at approximately 2202 hours, operations personnel started a load reduction to 90% power for the monthly turbine control valve testing. When the operator pushed the load selector decrease button for the second 2% reduction in power, the turbine commenced a rapid power decrease (2209 hours). This turbine runback resulted in an actuation of all fourteen steam dumps (including the PORV's to the atmosphere) and automatic rod insertion to compensate for the turbine runback. Operations personnel attempted to counter the loss of load by selecting manual increase; however, the turbine controls failed to respond and the turbine was manually tripped at 2217 hours when

power had decreased below the P-9 setpoint. An additional problem occurred when the exciter field breaker initially failed to open from the Main Control Board (MCB) following the trip. An operator was immediately dispatched to locally open the breaker. The breaker finally opened after several attempts to cycle it from the MCB.

Main feedwater was manually secured by operations at 2220 hours when the turbine runback transient caused a high level in the deareater (DA). The rapid increase in DA level led to a manual trip of the "B" condensate pump and the automatic tripping of "A" condensate pump. The condensate system was then aligned for restart and the "A" condensate pump was started. When main feedwater was restored at 2221 hours, the addition of cooler (280 degrees F) water caused a rapid RCS cooldown and steam generator levels to shrink to below the low-low steam generator level reactor trip setpoints. A reactor trip occurred at 2222 hours on "C" Steam Generator low-low level. With the exception of the previously mentioned problems, the plant response was normal. The plant was stabilized in Mode 3 until the cause of the malfunctions could be determined and corrected.

CAUSE OF EVENT:

The cause of the turbine runback was a relay contact failure in the turbine electrohydraulic control (EHC) load reference circuitry. Relay contacts for stator water cooling runback had shorted and remained closed when the operator pressed the load decrease button on the MCB. Instrumentation personnel replaced the circuit board which contained the defective component and returned the EHC system to operable status for a plant restart on December 3, 1989.

Subsequent investigations by engineering personnel determined that the component malfunction appeared to have resulted from a design deficiency. It is standard practice to connect a reverse biased diode across relay coils in the EHC circuitry to prevent high inductive voltages from being produced. A review of the runback circuit, which was modified in April of 1987, determined that a 24 VDC relay coil was connected to the failed contact without diodes. The contacts are rated for 500 volts; however, in a test on December 7, 1989 the vendor and South Carolina Electric & Gas Company (SCE&G) engineering personnel observed spikes of over 400 volts and that the contacts easily arced. The test confirmed that the contacts could short and cause the runback which occurred on December 2, 1989.

The failure of the Alterex exciter field breaker to open is a repeat occurrence. The previous failure which was noted in LER 88-002 dated March 11, 1988, was due to solidification of grease, whereas the latest failure was determined to have resulted from a lack of lubrication. The cause of the repeat failure was either due to personnel error or too long of a period between lubrications. Following the previous event, the type of grease applied for lubrication of this breaker was changed to prevent binding per the recommendations of IE Information Notice 87-12, "Potential Problems with Metal Clad Circuit Breakers, General Electric Type AKF-2- 25," and the frequency of preventative maintenance (PM) was set for every refueling outage. During an outage in November of 1988, the breaker was sent to a vendor for

refurbishment and on installation the PM was rescheduled for the next outage in 1990.

ANALYSIS OF EVENT:

This report is being submitted pursuant to the requirements of 10CFR50.73(2)(a)(iv). Notification to the NRC Operations Center via the Emergency Notification System was made at 0030 hours on December 3, 1989,

per the requirements of 10CFR50.72(b)(2)(ii).

With the exception of the Alterex exciter field breaker, the plant responded as expected to the turbine runback and subsequent reactor trip. During the runback, reactor power was decreased through rod insertion and emergency boration. As previously stated, increasing levels in the DA following the manual trip of the turbine resulted in loss of condensate pumps, and during the recovery process the addition of main feedwater led to a shrink in steam generator levels and subsequent reactor trip from approximately 5% RTP. The turbine driven emergency feedwater (TDEFW) pump started when the trip occurred due to the low-low level in all three steam generators and operated for approximately five minutes before being manually tripped by the operator. The plant cooled down to 530 degrees F during the transient and was stabilized in Mode 3.

Because of minor primary to secondary leakage in the steam generators, the TDEFW pump and the power operated relief valve operations resulted in a release of gaseous effluents. Calculations performed in accordance with Technical Specification 3.11.2.1 determined that the release was neligible (

IMMEDIATE CORRECTIVE ACTION:

Following the reactor trip, the operating shift placed the plant in a stable condition in accordance with Emergency Operating Procedure (EOP) 1.0, "Reactor Trip/Safety Injection Actuation," and EOP-1.1, "Reactor Trip Recovery." Maintenance was then directed to investigate and repair the noted equipment failures. The EHC card was replaced and the exciter field breaker PM'd prior to authorizing the plant restart.

ADDITIONAL CORRECTIVE ACTION:

The following additional actions were initiated by SCE&G to prevent a similar reoccurrence:

1. The circuitry of the EHC card was analyzed and determined to contain a design deficiency in that diodes were not installed to prevent high inductive voltages. This deficiency was confirmed through testing on December 7, 1989.

2. A modification to install diodes in the circuitry was performed on December 29, 1989.

3. Maintenance has been directed to inspect and lubricate if

necessary the exciter field breaker at approximately six month intervals (actual time is dependent on frequency of outages) until the reliability of the breaker can be established.

PRIOR OCCURRENCES:

LER 88-002, dated March 11, 1988

ATTACHMENT 1 TO 9001100063 PAGE 1 OF 1

South Carolina Electric & Gas Company Ollie S. Bradham
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SCE&G

January 2, 1990

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Virgil C. Summer Nuclear Station
Docket No. 50/395
Operating License No. NPF-12
LER 89-020

Gentlemen:

Attached is Licensee Event Report No. 89-020 for the Virgil C. Summer Nuclear Station. This report is submitted pursuant to the requirements of 10CFR50.73(a)(2)(iv). Should there be any questions, please call us at your convenience.

Very truly yours,

O. S. Bradham

CJM/OSB:lcd
Attachment

c: D. A. Nauman/O. W. Dixon, Jr./T. C. Nichols, Jr

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